Original article

Risk factors for gonorrhoea: case-control study

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Objective: To define risk factors for gonococcal infection.
Methods: A case-control study comparing 200 gonorrhoea cases with 400 patients with non-gonococcal genitourinary infections and 400 patients with various skin diseases, all of them attending City Department for Skin and Venereal Diseases in Belgrade (Yugoslavia) from October 1993 to December 1994.
Results: According to multivariate logistic regression analysis the following factors were significantly related to gonorrhoea in men: education level, sexual contact same day as meeting, condom use, history of prior gonorrhoea, and casual and/or new sex partner in the past month. Age, sexual contact same day as meeting, number of partners in the past year, and frequency of sexual intercourse in the past month were independently, significantly related to gonorrhoea in women. Also, in females, gonorrhoea was significantly more frequent in industrial workers and supported people.
Conclusion: Since sexual behaviour, low education level, younger ages, and low socioeconomic status were found to be related to gonococcal infection, health education at early age seems to be the most appropriate means of altering high risk behaviour.
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Keywords: gonorrhoea; sexual behaviour; risk factors

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Introduction

The prevalence of gonorrhoea in communities is determined by the interplay between biological characteristics of *Neisseria gonorrhoeae* and the behavioural characteristics of infected individuals.[1] Since knowledge on sexual behaviours of our population is rather scanty we have undertaken a case-control study in order to define factors that place individuals at increased risk not only for gonorrhoea, but also for all sexually transmitted diseases (STD).

Material and methods

From October 1993 to December 1994 patients attending City Department for Skin and Venereal Diseases at Belgrade because of urogenital symptoms (except of those coming for cure evaluation) were invited to participate in the study together with the patients attending the same institution for various skin diseases. Standard laboratory examination for gonorrhoea (native microscopy and inoculation on culture media) was performed on consecutive patients with urogenital symptoms. The sites for specimen collection in women were endocervical canal and urethra, and in men urethra alone. Specimens were seeded directly on the growth medium: modified Thayer Martin consisting of GC agar base + haemoglobin + PolyVitex (bioMe'rieux) with selective antimicrobial VCN mixture (bioMe'rieux). Identification of colonies with gonococcal-like appearance has been made by Gram stain, positive oxidase test (bioMe'rieux), and penicillinase production by CEFINAS test (BBL). Patients with gonorrhoea (200 cases, 161 men and 39 women) were compared with two control groups. The first control comprised 400 patients (317 men and 83 women) who, according to the laboratory examination, had other genitourinary infections but not gonorrhoea. The second control group consisted of 400 patients (310 men and 90 women) with various skin diseases. Laboratory examination on gonorrhoea was not performed on these patients. Data on demographic characteristics, detailed sexual history and sexual behaviour, history of sexually transmitted diseases, and the influence of AIDS occurrence on sexual behaviour, as well as data on alcohol and drug use and antisocial behaviour were collected from all participants by the use of an anonymous questionnaire.

In the analysis of data univariate and multivariate logistic regression analyses were applied.

Results

Demographic characteristics of gonorrhoea cases and their controls are presented in table 1.

According to univariate logistic regression analysis male gonorrhoea cases did not differ from controls by age and marital status, but significantly they more frequently had lower education level and were service sector workers.

In comparison with both control groups female gonorrhoea cases were significantly younger and with a lower education level. They were also more frequently industrial workers or supported people (students and housewives), and in comparison with control group II, more often single.

The majority of cases and controls had their first sexual intercourse in the age of 15–19 (table 2). A greater percentage of cases than controls began sexual activity before age of 15,

Table 1 Demographic characteristics of patients with gonorrhoea and their controls in men and women (p value according to age adjusted univariate logistic regression analysis)

Variable	Men			Women		
	Cases (n = 161) %	Control I (n = 317) %	Control II (n = 310) %	Cases (n = 39) %	Control I (n = 83) %	Control II (n = 90) %
Age (years):						
< 19	5·0	2·8	3·8	25·6	6·0	1·1
20–24	21·8	16·9	16·8	46·2	25·3	20·0
25–29	20·5	25·2	24·5	5·1	18·1	38·0
30+	52·7	56·1	54·9	23·1	50·6	60·9
p Value		NS	NS		0·0072	0·0000
Marital status:						
Never married	53·4	59·0	52·6	64·2	39·8	40·0
Married	39·7	34·7	44·2	23·0	50·6	53·4
Divorced and widowed	6·9	6·3	3·2	12·8	9·6	6·6
p Value		NS	NS		NS	0·0051
Education:						
⩽ Elementary	18·6	6·3	5·8	17·9	7·2	4·4
Secondary	60·9	61·5	63·2	74·3	53·0	64·4
High	20·5	32·2	31·0	7·8	39·8	31·2
p Value		0·0023	0·0018		0·0036	0·0068
Occupation:						
Industrial worker	31·0	26·2	33·2	15·4	6·0*	7·7*
Service sector worker	26·7	19·5*	14·8*	20·5	15·7	14·4
Trade worker	5·6	4·7	2·9	0·0	4·8	8·8
White collar worker	21·0	31·8	36·7	12·9	48·2	52·6
Other	5·0	3·8	4·5	0·0	2·4	5·5
Supported person†	6·4	9·6	6·3	46·1	19·3	7·7*
Unemployed	4·3	4·4	1·6	5·1	3·6	3·3

*P < 0·05 in comparison with all other occupational groups.
†Students and housewives.

Table 2 Sexual behaviour and frequency of sexually transmitted diseases in patients with gonorrhoea and their controls (p value according to age adjusted univariate logistic regression analysis)

Variable	Men			Women		
	Cases (n = 161) %	Control I (n = 317) %	Control II (n = 31) %	Cases (n = 39) %	Control I (n = 83) %	Control II (n = 90) %
Age at first sexual intercourse:						
< 15	16·8	13·9	6·1	7·8	0·0	2·2
15–19	73·9	77·6	75·8	74·3	66·3	62·2
20–29	9·3	8·5	18·1	17·9	33·7	35·6
p Value		NS	NS		NS	NS
Sex for money:						
Never	50·9	62·5	83·9	56·5	80·7	95·6
Sometimes	40·4	34·0	15·5	33·3	18·1	4·4
Frequently	8·7	3·5	0·6	10·2	1·2	0·0
p Value		0·0257	0·0003		0·0079	0·0027
Sexual contact same day as meeting:						
Never	12·4	37·2	57·7	46·1	77·1	93·4
Sometimes	54·6	47·9	40·6	46·1	20·5	6·6
Frequently	33·0	14·9	1·7	7·8	2·4	0·0
p Value		0·0032	0·0018		0·0023	0·0011
Condom use:						
Never	57·2	48·9	58·4	56·3	61·5	71·2
Sometimes	33·5	30·9	18·0	41·1	19·3	15·5
Frequently and always	9·3	20·2	23·6	2·6	19·2	13·3
p Value		0·0153	0·0081		0·0173	0·0025
Prior gonorrhoea	47·8	21·7	6·3	5·1	3·6	1·1
p Value		0·0009	0·0000		0·0351	0·0279
History of other STD*	49·7	35·3	11·2	15·4	20·1	4·4
p Value		0·0063	0·0047		NS	NS
Changes in sexual behaviour because of AIDS	47·2	55·2	47·8	23·2	24·0	13·2
p Value		NS	NS		NS	0·0031

*STD = sexually transmitted diseases.

whereas a greater percentage of controls had their first sexual intercourse when 20 years old or more. Those with gonorrhoea more frequently had sex for money and had sexual contact on the same day as meeting. Use of condoms was significantly less frequent among cases than among controls. A significantly greater percentage of cases, both men and women, reported previous gonorrhoea in their personal history. In male cases other STDs were also more frequent. About half of our male participants (cases and controls) and about a quarter of female participants reported changes in sexual behaviour because of AIDS. In the majority of them the change comprised more frequent use of condoms and avoiding "risky" sex (table 2).

In comparison with all controls, male and female gonorrhoea patients had a significantly greater number of lifetime sex partners and greater number of heterosexual partners in the past year and in the past month (table 3). In the month before the survey, gonorrhoea cases of both sexes had sex with casual and/or new partners more frequently and less frequently with regular ones, and they had sexual intercourse more often than controls. In comparison with the control group male gonorrhoea patients had significantly more homosexual partners in the past month.

Male gonorrhoea patients consumed alcohol more frequently in comparison with both control groups (table 4). They were also more frequently prosecuted for minor offences and for

Table 3 Sexual activity of patients with gonorrhoea and their controls (p value according to age adjusted univariate logistic regression analysis)

Variable	Men			Women		
	Cases (n = 200) %	Control I (n = 317) %	Control II (n = 310) %	Cases (n = 39) %	Control I (n = 83) %	Control II (n = 90) %
No of lifetime partners:						
0–5	9·3	12·6	29·0	46·3	67·5	81·1
6–10	9·9	24·9	34·2	33·3	26·5	16·7
11–20	10·5	24·3	19·4	10·2	4·8	2·2
21+	70·3	38·2	17·4	10·2	1·2	0·0
p Value		0·0077	0·0045		0·0127	0·0053
Sexual activity in the past year:						
No of heterosexual partners:						
0–1	15·9	24·2	60·3	28·2	77·2	87·9
2	10·5	18·9	17·0	25·6	15·6	7·7
3	74·0	56·9	22·7	46·2	7·2	4·4
p Value		0·0046	0·0087		0·0032	0·0027
Homosexual partners	3·1	2·2	0·6	2·6	3·6	1·1
p Value		NS	NS		NS	NS
Sexual activity in the past month:						
No of heterosexual partners:						
0	5·0	4·7	20·5	0·0	7·2	21·1
1	26·0	58·3	68·4	74·4	80·7	76·7
2	36·0	22·7	8·4	20·5	12·1	2·2
3+	33·0	14·3	2·7	5·1	0·0	0·0
p Value		0·0071	0·0093		0·0326	0·0031
Homosexual partners	3·7	3·2	0·3	5·1	6·0	0·0
p Value		NS	0·0020		NS	NS
Regular partner	56·5	67·5	74·8	59·0	78·3	77·8
p Value		0·0172	0·0040		NS	0·0253
Casual partner	55·9	34·7	13·6	35·9	18·1	2·2
p Value		0·0372	0·0023		NS	0·0043
New partner:	69·6	35·1	3·90	30·8	12·1	0·0
p Value		0·0061	0·0018		0·0403	0·0000
Frequency of sexual intercourse:						
0	0·0	3·8	20·3	2·6	6·0	22·4
⩽ 14	69·5	73·7	66·5	56·4	72·3	65·4
15+	30·5	22·5	13·2	41·0	21·7	12·2
p Value		0·0162	0·0038		0·0050	0·0061

Table 4 Some other characteristics of gonorrhoea patients and their controls (p values according to age adjusted univariate logistic regression analysis)

Variable	Men			Women		
	Cases (n = 200) %	Control I (n = 317) %	Control II (n = 310) %	Cases (n = 39) %	Control I (n = 83) %	Control II (n = 90) %
Alcohol consumption:						
No	29·2	37·0	55·2	71·9	73·5	80·0
Sometimes	50·9	56·1	42·2	23·0	22·9	18·9
Frequently	19·9	6·9	2·6	5·1	3·6	1·1
p Value		0·0077	0·0041		NS	NS
Drug use	3·1	2·2	1·0	2·6	0·0	0·0
p Value		NS	NS		NS	NS
Prosecution for minor offence	28·6	21·8	16·1	0·0	2·4	0·0
p Value		NS	0·0023		NS	
Prosecution for criminal offence	8·7	7·0	2·6	0·0	0·0	0·0
p Value		NS	0·0034			
Abandonment of the family	8·4	7·5	3·2	7·8	4·8	3·3
p Value		NS	NS		NS	NS

Table 5 Factors associated with gonorrhoea in men according to multiple logistic regression analysis

Variable	Coefficient	Standard error	Odds ratio	95% confidence interval
Cases in comparison with control I:				
Education	−0·7230	0·1941	0·48	0·33–0·71
Sexual contact same day as meeting	0·3944	0·1745	1·48	1·05–2·09
Condom use	−0·3802	0·1504	0·68	0·51–0·92
Prior gonorrhoea	0·4159	0·1246	1·51	1·19–1·93
Casual partner past month	1·0057	0·2343	2·73	1·73–4·33
New partner past month	1·3353	0·2384	3·80	2·38–6·06
Constant	0·0445	0·7076		
Cases in comparison with control II:				
Education	−0·9808	0·4620	0·37	0·15–0·93
Sexual contact same day as meeting	0·9098	0·4209	2·48	1·09–5·67
Prior gonorrhoea	2·6798	0·8228	14·58	2·91–73·15
New partner past month	1·8009	0·5629	6·05	2·01–18·25
Constant	0·8905	1·7108		

criminal offences than controls but the difference was significant only in comparison with control group II. Among study participants only 16 reported drug use and there were no significant differences between cases and controls. A greater percentage of cases than controls abandoned their family once or several times, but the difference was not significant.

All variables that according to univariate analysis were related to gonorrhoea at a level of $p < 0·05$ were included in the multivariate logistic regression model. According to the multivariate analysis the following factors were significantly related to gonorrhoea in men: education, sexual contact same day as meeting, condom use, history of gonorrhoea, and casual and/or new sex partners in the past month (table 5).

In women, according to multivariate analysis, the following factors were significantly related to gonorrhoea: age, sexual contact same day as meeting, number of heterosexual partners in the past year, and frequency of sexual intercourse in the past month. Cases also were significantly more frequently industrial workers and were financially supported (table 6)

Table 6 Factors associated with gonorrhoea in women according to multiple logistic regression analysis

Variable	*Coefficient*	*Standard error*	*Odds ratio*	*95% confidence interval*
Cases in comparison with control I:				
Age	−0·4411	0·1586	0·64	0·47–0·88
No of heterosexual partners past year	1·2469	0·2864	3·48	1·98–6·10
Industrial worker	1·5880	0·7236	4·89	1·18–20·21
Constant	−1·7255	0·7197		
Cases in comparison with control II:				
Sexual contact same day as meeting	3·0176	0·8450	20·44	3·90–107·10
No of heterosexual partners past year	1·2607	0·4067	3·53	1·59–7·83
Frequency of sexual intercourse past month	0·8314	0·3317	2·30	1·20–4·40
Supported people*	2·6086	0·7821	13·58	2·93–62·90
Constant	−9·7077	1·9838		

*Students and housewives.

Discussion

The study attempted to better define the factors that may contribute to gonococcal infection. Identification of such factors may ultimately contribute to more efficient STD intervention activities by permitting targeting of behaviourally and demographically defined subgroups which are at increased risk for gonorrhoea.

In the present study we compared gonorrhoea patients with two control groups taking into account the possibility that those with gonococcal infection did not differ a lot from patients with other genitourinary infections, or at least, differed less than from those who were visiting the doctor for some other reason. Indeed, the majority of factors related to gonococcal infection were less frequent in control group II than in control group I, but most frequently cases either differed or did not differ at the same time from both control groups. We did not test for differences between the two control groups in order to combine them if they were similar, since in the group II laboratory examination on gonococcal infection was not performed. The results obtained were discussed irrespective of the type of controls from which cases significantly differed.

Our results are in agreement with the majority of other studies. Lower education level and sexual contact on the same day as meeting, significantly independently related to gonorrhoea in this study, were also reported as risk factors for gonococcal infection in both sexes by Brooks *et al.*[2] In our study sex with an occasional or a new partner in the past month was strongly related to the risk of gonorrhoea in men. According to Upchurch *et al*[1] men with either a new or casual sexual partner in the previous month were more than 2·5 times more likely to have gonorrhoea than men without such partners. Recent sexual activity with a new or casual partner was also found to be associated with gonorrhoea in the study of Hook *et al.*[3]

Previous gonococcal infection more frequently reported by our cases than controls is a well known risk factor. In Richert *et al*'s study[4] a previous history of gonorrhoea was also an independent risk factor for new gonococcal infection with odds ratio of 2·6.

More frequent use of condoms by controls than cases was expected. It is obvious that condom use effectively reduces the risk of gonorrhoea and its more frequent use in the general population and in high risk groups (prostitutes and homosexuals) decreased the incidence of gonorrhoea in the Netherlands[5] and other western European countries.[6 7]

In the present study in women risk factors for gonorrhoea were also younger age, number of heterosexual partners in the past year, and frequency of sexual intercourse in the past month. The highest risk in the youngest could be explained by behavioural and biological characteristics. Young women have no experience in the selection of partner, they are attracted by older promiscuous men who are more likely to transmit gonorrhoea to them than partners of the same age would be. Also, younger women tend to have a larger number of potential "target cells" for gonococcal infection than older women.[8] The number of sexual partners in the past year, but not in the past month, as the risk factor for our female cases could be explained by the fact that gonococcal infection in women is frequently asymptomatic and consequently it is difficult to determine the exact time of infection. The relation between gonorrhoea and the frequency of sexual intercourse in the past month can be explained by higher and/or repeated exposure.

The fact that our female cases were more frequently industrial workers or supported people could be partly explained by their lower education level and consequently lower health education, and lower socioeconomic status. Rice *et al*[9] found that gonorrhoea incidence is associated with socioeconomic status and education level.

In summary, sexual behaviour, low education level, young age, and low socioeconomic status were found to be positively related to gonococcal infection. Health education early at school and later in some subgroups, such as industrial workers, and through mass media, seems the most important contributing factor in efforts to alter sexual behaviour. The threat of AIDS could also be of help. The fact that one half of our male participants and almost one quarter of female participants changed their sexual behaviour for fear of AIDS provides encouragement.

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